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NORTH SEA

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Tor Inge Tjelta, Statoil

Prod probes Statoil's seabed soils

An Australian-designed seabed drilling rig got the thumbs up from Statoil after completing a challenging geotechnical assignment for the Luva development in the Norwegian Sea and has now moved on to West African waters. **Jennifer Pallanich** reviews the provenance and performance of the 'Prod' system.

Making its European debut, Benthic Geotech's seabed drilling spread operated 1300m below the water line to obtain continuous cores down to 100m at Statoil's Luva field.

Statoil marine geotechnics and geohazards specialist Tor Inge Tjelta says his company first started thinking about using such a unit for continuous coring and testing of downhole soils for foundation purposes a couple of years ago. Carrying out shallow geotechnical drilling programmes from surface vessels raises a number of issues, he says, notably the time required to run the pipes through the water column and exposure to weather.

Placing the equipment on the seabed instead, he adds, makes everything much more efficient – a highly desirable outcome for Statoil given it samples every meter or so, which translates into lots of winching. Using a seabed drilling package would drop the distance winched from 1300-1400m in this case down to 50m or 100m, he notes, and the distance is even greater in deeper water. According to Tjelta, it becomes 'between five and ten times faster than the traditional work we do'.

Once the company bought into the seabed drilling idea, it conducted a survey of available systems in the market that might be up to the task. 'We scanned everything that was available around the world and we found four systems that potentially would be able to do it.'

After comparing the four systems, Statoil opted to go with Australian contractor Benthic Geotech, which largely had experience working in the Australasia region, and its Prod (portable, remotely operated drill) unit. An umbilical from the surface powers and controls this system, which is said to be unaffected by ship movement once landed on the seabed.

'We really wanted to see, "Can we use this technology in our soils?"' Tjelta explains.

The concern boiled down to the unit's ability to handle different rock types, as boulders are a feature of the shallower water sediments off Norway. 'When this rig hits a boulder, it switches to coring,' Tjelta says, adding it could handle granite, among other rock types.

According to Benthic Geotech, Prod can switch between diamond bit rotary drilling, piston sediment sampling and in situ testing in the same hole. To Peter Williamson, the company's CEO, the logic of using Prod rests on three legs – safety, control and efficiency – just as the unit itself sits on three legs.

'Drilling is a dangerous activity when there are roughnecks working on a deck,' he notes. 'Benthic's operators are sitting in a climate-controlled control room, operating it with a mouse.'

To make the design work, Tjelta says, 'they use a lot of ROV thinking with the umbilical going down to the seabed, and they have the control units and power units. You could call it crossover between an ROV and a standard drilling rig.'

Prod, which at 6m tall could almost be referred to as a mini-rig, is easier to control, Williamson says; that's partly because of its proximity to the area to be drilled and partly because of its size. 'The bigger the equipment, the harder it is to control it delicately,' he says.

Efficiency, Williamson adds, comes through the increased productivity of Prod, which can be three to five times faster than a drillship because there's no drillstring in the water. 'You get your survey done in a third of the time and it costs a lot less,' he says. Then again, he adds, operators often take advantage of the time savings to have the unit gather other data, often staying as long as a drillship would but gathering more information.

'We do tests that are much closer to what is actually going to be happening during the installation process,' Williamson says.

Benthic Geotech's work – focused on the top 100m or so of the seabed – is aimed at describing in detail the seabed soil in order to reduce installation risk by allowing the client to better design installation techniques.

'One of the advantages of what we do is we don't mess the seabed up while we're testing,' Williamson claims. This often happens with other systems, he says, because deepwater soil is very soft and heavy testing equipment will sink when deployed, thereby changing the composition of seabed. 'That's a big problem for most traditional technologies. The top few meters is destroyed by every other testing technology,' he says.

How it works

The Prod unit's two carousels hold about 260m of drilling tubular and testing tools in total and two manipulators are used to make up the drillstring.

It takes one to two hours to lower Prod, with its various cameras and sensors, to the seabed from the vessel. The arms extend as the unit nears the seafloor, at which point operators can view the landing zone and orient the system using thrusters so it lands in the desired location. On landing, more cable is paid out, a catenary is formed and the unit settles on a central base plate lowered to the mudline.

Williamson, who has a geology background, says Prod's positioning capability – to an accuracy of 25mm relative to the mudline – and the data it collects remove a lot of the uncertainties from flowline and riser design, which inaccurate data has traditionally made into a headache to design around.

For positioning, the rig sits on three

Benthic Geotech's Prod operators in the control room.

Deployment of the Prod seabed drilling unit at the Luva location in the Norwegian Sea.

Prod specifications	
Height, excluding main sheave wheel:	5.8m
Deck footprint (vertical, legs raised):	2.3m x 2.3m
Weight in air:	10t
Weight in water:	6t
Max operating depth below sea level:	2000m
Max sampling penetration depth:	125m
Max casing depth:	40m

'Making and breaking a thread sounds relatively simple, but making and breaking a thread safely and reliably was a complex engineering exercise.'
Peter Williamson, Benthic Geotech

legs, a result of working in challenging conditions around an escarpment with steep inclines. 'It is actually capable of staying vertical even if the seabed is sloping or has undulations,' explains Tjelta, pointing out that the unit can work on a 20° slope.

'When we take a sample at seabed, we know it's within a fraction of an inch,' Tjelta adds. 'It promotes a kind of control which is unusual and unheard of in the business.'

Today's Prod systems are handling a wider range of testing and sampling activities than was originally envisaged at the prototype stage. During the Luva project, for example, Benthic Geotech also installed a series of deepwater monitoring sites for Statoil. 'We never considered 10 years ago that there was a need for that,' Williamson says.

The original driver for the concept was the expense to scientists of using drillship technology to work in the deep ocean. A professor in the geology department at the University of Sydney came up with the original concept while working out how to acquire high-quality scientific samples at a lower cost. Prototype development began in 1997 and sea trials got underway in 2000. Following early applications in Puget Sound and the Great Barrier Reef, Australian oil & gas companies started showing an interest. The Prod unit's first offshore trial was for Origin Energy in 80m of water in the Bass Strait in 2001 and the following year it went to work for Woodside in similar water depths on the North West Shelf.

'The technology by about 2002 was proved,' says Williamson, who joined the company that year. From then until 2004, the company raised capital and continued its R&D into oil & gas applications. By 2005, Benthic Geotech was operating commercially. The bulk of the company's 22 commercial deployments to date have been oil & gas related, mostly in Australasian waters. Since breaking into the European market on the Luva project in mid-2009, the Prod working prototype – which did the Statoil job – has made its first strides into the West African offshore market. It has started work for Total in 1400m of water off Angola.

According to Williamson, two additional Prod units, both incorporating improvements on the working prototype, are now available for work. The design didn't come easy, Williamson notes. Difficulties, he asks? There were 'about four or five thousand . . . it's not that easy'. Some of the rough spots came with figuring out how to provide adequate control and communication during the complex task of making and breaking drillstring. 'Making and breaking a thread sounds relatively simple, but making and breaking a thread safely and reliably was a complex engineering exercise,' he says.

To accomplish the task of creating a fully functional geotechnical investigation rig, Benthic Geotech had to design its own suite of downhole sampling and testing tools since, Williamson says, existing tools simply weren't up to the job. Another design constraint came with the limitations of operating remotely with power. Here again the company opted to develop the required software and electronics in house.

'I can't say we're at the end of our R&D road at all,' Williamson says. 'We're a long way down the path, but we're improving our technology every day. We have a significant R&D budget.' OE

Before its European breakthrough at Luva last year, Prod system applications centred mainly on Australian waters. Here the working prototype is pictured undergoing wet tests in Sydney Harbour and (right) *during the unit's launch at Browse.*